

## CHAPTER 2

# General Planning and Design Considerations

### 2-1 GENERAL

a. **PLANNING.** The first part of this chapter (2-2 thru 2-5) provides procedures to aid in development of functional requirements and subsequent preparation of planning and programing documents. The library program is the planning base for developing requirements which are eventually embodied into a building program. This chapter discusses building program development, and in particular, how to determine space needs and related requirements for site improvements, furnishings, and equipment.

b. **DESIGN** The last part of this Chapter (2-6 thru 2-15) discusses basic considerations for design and review of library and technical information center projects in relation to the individual space criteria and space organization principles in the following chapters. The discussion includes the design requisites and documentation required, basic site development and building design criteria, considerations for related furnishings and equipment, and provisions for user information. In addition, there are several overriding considerations that must be accounted for in all aspects of design.

### 2-2 PLANNING REQUISITES AND DOCUMENTATION

The sequence of steps for planning is delineated in AR 415-15. Once a need for a library center has been recognized by the installation, the building functional requirements and subsequent space needs must be established and documented along with the requirements of the site and future interior furnishings. This is the responsibility of the installation although assistance (using installation funds) may be obtained from the design agency if needed. If the library is the main facility, documentation must be prepared as stated below. When the library is to be built as a part of a larger facility, such as a hospital or laboratory, the requirements for the library must be included in the documentation for the main facility.

a. **PROJECT DEVELOPMENT BROCHURES (PDB).** Documentation is accomplished by first preparing a PDB as required by AR 415-20 and discussed in TM 5-800-3. Project requirements for libraries will be established in conjunction with the procedures and criteria in this guide.

b. **DD FORM 1391 (MILITARY CONSTRUCTION PROJECT DATA).** Preparation of DD Form 1391, with detailed justification paragraphs, is discussed in AR 415-15. Prepa-

ration of this form should be supported by the PDB previously prepared. All data entered on the DD Form 1391 must be carefully considered since project design must adhere to the requirements and estimates established thereon, as approved by HQDA. In preparing DD Form 1391, "DG 1110-3-110" should be entered under detailed justifications concerning criteria for libraries.

### 2-3 ANALYZING THE SITE AND LIBRARY LOCATION

a. **APPROVED CENTRAL SITE PLAN.** If the library is an independent building, the site shall be as shown on the HQDA approved Master Plan of the installation. If the facility is not shown thereon, a location must be selected and an approval obtained in accordance with AR 210-20. Location must be determined in response to the facility's functional requirements and take into account accessibility, capability for expansion, etc.

b. **PRELIMINARY SITE LAYOUT.** Although a detailed site plan is not normally required for submission with DD Form 1391, preparation of a site layout for independent library buildings will assist in preliminary budgeting. Tentative orientation of the facility should take into consideration the following factors:

- (1) Convenience of access for pedestrians, drivers, and service vehicles.
- (2) Sun angles and direction of prevailing wind.
- (3) Land Forms, grading, drainage and the tree coverage.
- (4) Views (desirable and undesirable).
- (5) Size location and sufficiency of utility connections.
- (6) Future expansion possibilities.

c. **ESTIMATING SITE COST.** Empirical cost estimating data are given in AR 415-17. Establishing the cost for the site is most important and should be made with the aid of a site layout sketch in conjunction with building requirements. Individual items should be listed under "Supporting Facilities" on DD Form 1391. The following list indicates typical items that should be considered:

- Site preparation
- Demolition
- Grading\* and excavation
- Paving (drives, parking, and walks) \*
- Fencing
- Landscape planting
- Signage\*
- Water
- Sanitary sewer
- Gas

\* including features for the physically handicapped

- Exterior electric service
- Communications
- Special foundations
- Others, as appropriate

d. **LOCATION WITHIN LARGER FACILITY.** When the library is to be a part of a larger facility or building, the library should be located on the ground floor, if possible, to reduce structural problems. Other factors which should be considered in locating the library are:

- Access and proximity to users
- Access to service areas
- Fire separation areas
- Relative quiet and uncongested area conducive to study
- Proximity to break and vending facilities

e. **LOCATION WITHIN REHABILITATED FACILITIES.** In addition to the factors listed above, proposed locations of libraries in rehabilitated spaces must be carefully analyzed since the strength of the existing supporting structure will drastically change the area requirements of the library. A library relocated to a building or area with relatively light structural floor framing will require a wider spacing of stacks than if relocated to a building or area with heavy framing members.

## 2-4 PLANNING THE BUILDING

a. **GENERAL METHOD.** It is the responsibility of the library director to determine how much space will be required for the facility. Space requirements for any Army library are based on the mission, function, and collection size of the library projected over the next 5 years. These functions, services, and activities require certain furniture and equipment for their performance. That furniture and equipment, in turn, requires a determinate amount of space for location and access. The total of these spaces constitutes the actual space requirement, without which the library cannot fulfill its total mission. The assessment

of space requirements can be facilitated by an analysis based on space requirements for the collection, readers, staff, and support activities. Space requirements for planning most library functional units are presented in Chapter 3.

b. **SPACE REQUIREMENTS FOR THE COLLECTION.** A list of present and projected materials must be prepared by the librarian for use by the design agency. The number of collection storage units required for each type of material can be computed by dividing the number of projected items of the collection by the number of items per storage unit shown in Table 3-1 or 3-2 and rounding up. The number of storage units thus derived is then multiplied by the net assignable square feet per unit (NASF/unit) shown in table 3-2 to determine the actual space requirement for each type of material. Example: to store 15,680 reels of 35mm microfilm:

$$15,680 \text{ 35mm microfilm reels} \div 160 \text{ reels/drawer} = 98 \text{ drawers}$$

$$98 \text{ drawers} \div 4 \text{ drawers/unit} = 24.5 \text{ units or 25 units}$$

$$25 \text{ units} \times 15 \text{ NASF/unit} = 375 \text{ NASF}$$

The area requirement obtained in this way represents the total floor space required for storage and access to the item. By repeating this process for each type of material in the collection and adding the results, the total actual space requirement for the collection can be derived.

c. **SPACE REQUIREMENTS FOR READING AND STUDY.** There are three bases commonly used for determining the number of reader stations required. The basis used for computation must be relevant to the nature of the facility being planned and the user information available to the librarian.

(1) *Based on Collection Size.* Determination of reader stations for general, main post, branch post, and school libraries, and other libraries with similar usage characteristics should be based on the following formulas:

$$\text{NASF for User Seating} = 1.15 \times \text{NASF for collection}$$

$$\text{No. of reader stations} = \frac{\text{NASF for user seating}}{30 \text{ sf/reader station}}$$

(2) *Based on Experience*

(a) Where documented statistics are available concerning the number and types of users, these may be used as the basis for determining seating requirements. These must be evaluated against possible future changes in mission or use. Due to the effects of crowding on work efficiency and on the psychological "territory" required by workers, some kinds of reader stations are more efficiently used than others (see Table 2-1). Thus, individual study carrels are completely filled by one person, but multi-chair tables will seldom be filled to capacity. If 16 table and chairs are expected to be occupied during daily peak periods, 20 table and chair seats should be provided ( $16 \times 1.25 = 20$ ) to allow comfortable working conditions and to handle occasional overloads.

(b) The peak load factor shown in Table 2-1 may be used to predict the effect of peak loads on the number of seats to be provided. Thus, if statistics indicate an average of 8 lounge seats are occupied during the day, then  $8 \times 1.67$  or 14 seats will be occupied during peak periods and  $14 \times 1.5$  or 16 lounge seats should be provided.

TABLE 2-1 FURNITURE UTILIZATION FACTORS

Reader Station	Comfort Factor	Peak Load Factor
Lounge	1.15	1.67
Table (General Reading)	1.25	1.50
Table (Conference and Seminar)	1.0	1.0
Carrel	1.0	1.25
Research Carrel	1.0	1.0
Terminal	1.0	1.0
Microform/AV, Index Tables	1.0	1.0
Typing/Listening	1.0	2.0

(c) If additional reader stations are contemplated for an existing collection, the number should be based on present seating inadequacy and justified by documented measurements of overcrowding during peak hours.

(d) If an existing collection is to be moved into new quarters, requests for additional seating should be based on considerations discussed above and on 5-year growth projections.

(3) *Based on Functional Requirements.* For most specialized library types, such as science and technical information facilities, seating must be determined based on an analysis of the functional activities supported by the facility. The type of seating necessary will be a function of the type and duration of the activity, the concentration level required, and the number of personnel participating jointly in each activity. The required number of each type of seating is a function of the number of times an activity is exercised daily, and the number of persons jointly involved in each exercise, as well as the comfort factor and the peak load factor described in Table 2-1. In Table 2-2, each type of seating is listed with the corresponding types of activities, durations, and personnel participation appropriate for it. Concentration levels are also listed from "1", denoting a minimal concentration level of short duration to "5", denoting intense concentration sustained over more than 8 hours. Table 2-2 should be analyzed to determine which activities are necessary to the performance of the mission and how many of each seating type are necessary to assure adequate access to the function by facility users. For instance, if browsing is an activity that is expected to occur approximately 40 times per 8 hour day and last on the average  $1/3$  hour for each browsing exercise, then the number of seats required for browsing is  $40 \times .5 \text{ hr} \div 8 \text{ hr} = 2.5$  seats. These may be assigned to table or lounge

seating. The total seats required for each type of seating is determined by performing similar calculations for each activity, summing them and multiplying by appropriate utilization factors from Table 2-1. The following calculations are given as a possible example for table seating determinations:

Conversation	1.3 Seats
Browsing	2.5
Review technical articles	.3
Information search	.4
Problem solving	1.5
Study technical literature	.8
Total	6.8 seats
x Peak load factor	1.50
	10.2 seats
x Comfort factor	1.25
	12.75 seats

(Two tables seating 6 each should be provided.)

(4) *Reader Station Distribution.* All of the above methods, except that based on functional requirements, must be further analyzed to distribute the total number of reader stations among the various types indicated in Table 2-2. This distribution must be carefully reviewed to ensure that an adequate number of each type of station is available to meet each functional demand.

(5) *Actual Reader Station Space Requirement.* The total number of each type of distributed reader stations must be multiplied by the appropriate space factors found in Chapter 3 to obtain the total actual reader station space requirements.

d. **SPACE REQUIREMENTS FOR STAFF.** Space requirements for staff work stations are based on the staffing authorized for the library and the activities which each member of the staff must perform. Some members of the staff may require multiple work stations. Some work stations may be shared by several staff members. A work plan should be completed listing each function and activity performed by the staff, the equipment necessary for performance of each task, and the number of each type of equipment. A space requirement can then be generated by multiplying the number of each type of equipment by the appropriate space factor contained in Chapter 3 and totaling these. Some of the more common work stations are indicated in Chapter 4.

e. **SPACE REQUIREMENTS FOR SUPPORT SERVICES.** Space requirements for services which support the library can be determined by referring to the appropriate item in Chapter 4 or in Chapters 6 through 12. If a special service is required for an activity not contained in this guide, the space requirement may be computed using unit factors found in Chapter 3 and supplementary equipment catalog information.

TABLE 2-2 SEATING FOR FUNCTIONAL ACTIVITIES

Activity	Concentration Level	Duration	Personnel Participation	Type of Seating
Relaxation	1	Less Than 1 Hour	1	Lounge
Conversation	1	Less Than 10 Minutes	2-3	Lounge, Table
Discussion	3	More than 10 Minutes	2-12	Seminar
Browsing	2	Less Than 1 Hour	1	Lounge, Table
Music Listening	1	1 Hour + o r -	1	Lounge
	3	1-2 Hours	1	Listening Booth
Listening to Conference Recordings	4	1-4 Hours	1-3	Listening Booth
Participation in Teleconference	3-4	up to 8 Hours	1-12	Teleconference room
Review of Technical Articles	2	1 Hour	1	Lounge, Table
	4	1-2 Hours	1	Carrel
Bibliography Search	3	½ Hour	1	Index Table Carrel
Information Search	3	up to 1 Hour	1	Table
	4	2 to 8 Hours	1	Carrel
Problem Solving	5	More than 8 Hours	2-4	Research Carrel, Seminar Room
	3	up to 2 Hours	1	Table
	4	2-8 Hours	1	Carrel
	5	More Than 8 Hours	1	Research Carrel
	5	—	2-12	Seminar Room
Study Technical Literature	3	Less Than 1 Hour	1	Table
	4	1-8 Hours	1	Carrel
	5	More Than 8 Hours	1	Research Carrel
Computer Search	4	1-4 Hours	1	Terminal
Self-Paced Instruction	4	1-4 Hours	1	AV Carrel
Typing	3	1-4 Hours	1	Typing Carrel
Reading for interest	3	1-2 Hours	1	Lounge, Table
Microform Search	3	1-2 Hours	1	Microform Viewer

f. **TOTAL ACTUAL SPACE NEEDS.** A summary of all the NASF space requirements generated by the above procedures should be developed for each project, in the format of Table 6-6. The sum of these requirements, multiplied by 1.15 to allow for unassignable building area, such as circulation, walls, and duct space, is the total actual gross area (GSF) required for the library. Example:

Total Actual NASF requirement = 25,652 NASF  
 Unassignable Bldg. Area (15%) = 3,848  
 Total Actual Gross Area Requirement = 29,500 GSF

If the facility is a Main Post or Branch Post Library the gross area requirement obtained above must be compared to the maximum gross area allowed by DOD. This is shown in Table 6-3, col 2, for Main Post Libraries and is 4000 SF for Branch Post Libraries. If the total actual gross area exceeds the DOD allowance the area requirement must be reduced by eliminating or reducing functions or collection until it meets the allowance. Space for mechanical equipment for heating, ventilation and air-conditioning should then be determined by an engineer taking into account central heating sources, solar application etc., and added to the gross area requirement. The sum obtained is the total space needed for the project for which funding must be programmed. See AR 415-15, 415-35 and 230-1 for fund programming procedures for regular MCA, minor MCA, and non-appropriated funds, respectively.

g. **EXAMPLE DETERMINATIONS OF NEEDS.** Detailed development of space needs based on collection size is demonstrated for Main Post Libraries in Chapter 6. Development of space needs using other methods is similar. Differences are stated above.

h. **ESTIMATING BUILDING COST.** AR 415-17 provides empirical cost estimating data for all types of facilities. The unit cost data shown in AR 415-17 for libraries includes equipment and furniture which is permanently built-in or attached to the structure. The following list indicates typical items that should be estimated as part of the building cost:

- ( 1) Built-in counters, sinks, and cabinets
- ( 2) Efficiency kitchen unit
- ( 3) Central PA and record-playing console and sound system
- ( 4) Telephone outlets
- ( 5) Computer terminal lines
- ( 6) Built-in typing and record playing counters
- ( 7) Built-in shelving and shelving mounted on tracks laid into floor
- ( 8) Built-in movable partitions
- ( 9) Built-in projection screens, bulletin boards, and display cases
- (10) Elevators and book conveyors
- (11) Floor and window coverings (except area rugs)

- (12) Signage and graphics
- (13) Other items normally installed as a permanent part of a building.

As a general rule, unit building costs for all types of libraries and technical information centers will be similar. For facilities such as hospitals and schools, which normally incorporate libraries, the unit cost shown in AR 415-17 for the overall facility need no adjustment for a library. For a facility such as an engineering office, an aggregate unit cost can be derived by prorating unit costs for office, library, and laboratory areas.

## 2-5 PLANNING RELATED FURNISHINGS AND EQUIPMENT

a. **COORDINATING REQUIREMENTS.** Principal items of furnishing and equipment are listed in the chapters dealing with each type of library under each individual space, generally on the figures showing space layout. Furniture and equipment that are portable or detached from the structure must be furnished by the installation. These items will be funded from an appropriation other than construction, and their procurement must be carefully coordinated to ensure that they will be available when required. All related furnishings and equipment needs must be identified in conjunction with planning the building in order to develop a totally integrated and useful facility; and in order to program funds and provide information on delivery schedules in relation to construction. In preparing DD Form 1391, plans for related furnishings and equipment must be described in detailed justifications.

b. **ESTIMATING FURNISHINGS AND EQUIPMENT COSTS.** Items "on hand" meeting furnishings and equipment requirements should be listed separately from items that must be procured. Sources for selection of furnishings and equipment to be procured, are provided in the GSA Federal Supply Schedules, the Federal Prison Industries Schedule of Products, and the general GSA supply catalog. These sources are mandatory, insofar as they meet requirements, and cost estimates should be based on prices therein escalated to time of actual procurement to meet the established delivery schedule. Quality factors relevant to the selection of furnishings are discussed later in this chapter. The following list indicates typical items of equipment and furnishings that should be considered.

- ( 1) Audio-visual equipment, TV systems
- ( 2) Training equipment and instructional apparatus
- ( 3) Desks, chairs, tables, and study carrels
- ( 4) Lounge furniture
- ( 5) Book stacks
- ( 6) Book trucks, storage and filing cabinets
- ( 7) Card catalogs and map cases
- ( 8) Microform equipment
- ( 9) Computer terminals
- (10) Reproduction machines
- (11) Telecommunication equipment

- (12) Wall clocks: Plug in
- (13) Outside furniture
- (14) Other items which are detachable or portable

## 2-6 GENERAL DESIGN CONSIDERATIONS

a. **BARRIER FREE DESIGN.** Libraries and Technical information centers must be accessible to all persons. Provisions will conform to the most current DoD criteria regarding design for the physically handicapped. Barrier free design is extremely important in both site development and building design and will provide valuable conveniences to the able-bodied as well as the handicapped. Sites and buildings must be organized in the early stages of design to ease access and egress in and around the facility: level changes must be negotiable by persons using wheelchairs, crutches, or braces; toilet rooms must be located, sized, and equipped to accommodate handicapped men and women; provisions must be made for parking, wheelchairs, and for seating crutch and brace users in carrels and typing booths, etc. Consideration must also be given to hard-of-hearing and visually handicapped persons. In multi-level libraries the service elevator, required to transport books, must be sized and located to accommodate wheelchair users,

b. **ENERGY CONSERVATION** Design of all Army facilities must be responsive to the requirement for conservation of natural resources. Natural environmental factors which tend to conserve energy (i.e., vegetation, orientation, "protection from winds, etc. ) should be enhanced by the design. Building designs should incorporate passive energy design measures such as roof overhangs and sunscreens, and consideration should be given to use of active energy conversion systems such as solar heating. Many libraries have been successfully built underground or in a semi-buried location. The architect should consider the full potential of the site and energy-related activities of the facility in order to maximize the energy utilization efficiency of the design,

c. **LIFE CYCLE ENHANCEMENT.** During design, consideration must be given not only to the initial cost of construction, but also to the cost of operation, maintenance, and custodial care during the intended life of the building. Both initial and life cycle costs must be analyzed, especially in the selection of utility systems, exterior materials and interior finishes.

d. **OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA).** The staff area of post libraries and all areas of other types of libraries should satisfy the work safety standards required by OSHA. ETL 1110-1-87 furnishes guidance concerning the application of these standards. Where a conflict exists between OSHA and DOD criteria, the more stringent criteria must be applied.

e. **LIBRARY TECHNOLOGY.** Present and anticipated technology must be considered in library planning because of its impact on space organization, staff requirements, mechanical, electrical and acoustic requirements,

as well as the space and storage requirements of the hardware itself. In addition to the technology which is already utilized in libraries, a number of other technological advances have present and future library/information center application. These include: telefacsimile; ultra microfiche; digital mass storage media; closed circuit and cable TV; mini-computers; laser recording and satellite transmission of information. These technologies are applicable in all types of libraries and consideration must be given in the design of libraries, and technical information centers to allow for their incorporation.

## 2-7 DESIGN REQUISITES AND DOCUMENTATION.

Project design development is discussed in AR 415-20. Use of the Project Development Brochure and DD Form 1391 data as approved by HQDA for inclusion in the proposed (or approved) military construction program, is prerequisite to design development which is the responsibility of the design agency.

a. **CONCEPT DESIGN.** Initially, concept design drawings and analysis are required to help verify costs, and further define the functional aspects of the facility before initiation of final design. Generally, the concept design will be completed by the design agency and approved by the installation before construction funds are actually appropriated. The following level of detail in documentation is required.

(1) *Site Plans.* Site plans will show, as a minimum, floor elevations, existing and finished grades, existing and proposed buildings, roads, parking, and utilities in the immediate project vicinity, outside utility connections, signage, existing vegetation, proposed lawns and planting masses, and solar orientation. Grading, paving, utility and landscape development plans must also be shown.

(2) *Design Drawings.* Design drawings will include as a minimum a graphic description of the design, including floor plans, sections, and elevations, with sufficient detail to describe the geometric and construction characteristics of the building; written specifications describing the required properties and/or performance of the construction, including materials, installation, workmanship, and methods; and an *interior design scheme* with complete schedules of finishes, color, patterns, and furnishings and equipment (attached and detached).

(3) *Design Analyses.* Design analyses will contain supporting data for all aspects of the design, including architectural, structural, mechanical, electrical and communication, fire safety, etc. Cost estimates for both primary and supporting facilities will contain basic determinations commensurate with level of detail of the rest of the design.

b. **FINAL DESIGN.** Final design will be based on the approved concept design. To assure that approved concept requirements have been met, an in-process review of design documents by the installation should be made near completion of final design. Final documents must be sufficient to allow the project to proceed to competitive bidding and construction contract award. Basically, the final design.

will include a design analysis, drawings, and specifications prepared in accordance with ER 1110-345-700, 710, and 720, respectively.

## 2-8 SITE DEVELOPMENT

Design of supporting facilities as part of the site development will be consistent with the project requirements previously established. Successful site design is embodied in developing an appropriate relationship between building and site, an efficient vehicular and barrier-free pedestrian system, and an overall landscaping and signage plan. These considerations are discussed in the following paragraphs. Reference should also be made to TM 5-803-3, Site Planning.

a. BUILDING-SITE RELATIONSHIP. In developing an appropriate building-site relationship, the terrain, soil characteristics, local vegetation, and climatic conditions of the site must be considered along with the utilities support, and relationships to other buildings in the area.

(1) *Terrain Configuration and Site Coverage.* The site design process requires analysis of the scale and character of the geographic and topographic features of the site. Large scale features, such as site slope characteristics, generally require specific architectural and landscape responses. Both large and small scale features should be considered from the standpoint of their potential landscape value. The building should be designed to blend with the contours of the terrain. If other considerations, such as solar orientation, dictate that the building cross contours, a multi-level building may be desirable. As a rule of thumb, the maximum recommended coverage of the site by the building is 40 percent. Optimum coverage is generally considered to be about 30 percent. Allowances for future expansion should also be considered.

(2) *Soil Characteristics and Drainage.* The organic composition and drainage characteristics of the soil is important to the design of building foundations and the economy of construction, as well as to the landscaping of the site. The drainage characteristics and compressive bearing strength of the soil are critical in foundation design and must be determined in accordance with TM 5-818-1, Procedures for Foundation Design of Buildings and Other Structures. The determination of soil drainage characteristics will also include assessing the effects of the proposed building and its adjacent paved areas on the ground water level. Overlot grading must be established to provide positive drainage of the entire site away from the building and outside facilities. Grading should be designed for optimum preservation for existing ground forms and drainage patterns.

(3) *Vegetation and Tree Coverage.* Existing vegetation and trees should be preserved in their natural setting to the greatest extent possible consistent with functional requirements. This can help reduce the environmental affects of wind and sun as well as the requirements for landscape planting and temporary erosion controls.

(4) *Climatic Conditions.* Skillful utilization of natural

environmental controls can significantly increase building utility and efficiency.

(a) *Wind.* Structures affect air movement. They block or divert winds or channel them through narrow openings. Normally, the entrance should face away from the prevailing winds, or should be shielded by vegetation or part of the building. Features should be placed on the site so as to control wind-blown trash or snow, and aid in dispersal of emissions (smoke, fumes, dust).

(b) *Sun.* Solar controls should be planned to help achieve maximum energy savings. External shading devices are the most effective means of solar shading. Deciduous trees can provide shade in summer and penetration of sunlight in the winter. In general, buildings should be oriented so that the longest wall faces south, to minimize energy use.

(5) *Exterior Utilities.* Utility support systems must be carefully analyzed with respect to location, connection into the building and subsequent operation and maintenance. Utility areas, such as for transformers, trash collection areas, etc., shall be screened by use of plantings, land forms, or architectural screens to blend with the surroundings.

b. PEDESTRIAN AND VEHICULAR SYSTEM. A safe and convenient pedestrian and vehicular system must be established. The system should separate pedestrian and vehicular activities as much as possible and incorporate requirements for the physically handicapped in accordance with EM 1110-1-103.

(1) *Walkways.* The pedestrian system is essentially established by the pattern of walkways designed to support access and egress to and from usable entrances of the library. Generally, walkways should be designed to complement the natural flow of pedestrian traffic, be 6 ft. wide, and slope no more than 1 in 24, blending to a common level with other surfaces. Where significant level changes are required, both steps and ramps should be provided. Walks crossing roadways must be marked and provided with curb ramps, if curbs are used.

(2) *Roadways.* Vehicular arterials should not run between the library and closely related user facilities such as a school. A pedestrian drop-off and pick-up zone should be provided near the main entrance designed to be barrier free.

(3) *Parking.* DOD 4270-1-M allows one parking space per 500 SF for post libraries. Parking spaces for other types of libraries must be based on special traffic analyses in accordance with DOD 4270.1-M. Provide and reserve convenient parking for handicapped persons. Provisions for motorbikes and bicycles should also be made.

(4) *Service Access.* Service roads and areas should be separated whenever possible from pedestrian oriented roadways, parking and walkways. It is essential that the vehicular system provide access for fire fighting equipment as well as for deliveries. Service areas and service roads must be sized to accommodate the turning radii and maneuvering requirements of the largest

vehicles. At the same time, the extent of paving should be minimized. Screening for service areas should be accomplished in conjunction with the screening of utilities features.

c. **LANDSCAPING AND SIGNAGE PLAN.** In conjunction with establishing the building-site relationship and the pedestrian-vehicular system, a landscaping and signage plan will be developed.

(1) *Signage.* Direction signs and signs identifying buildings, parking areas, service areas, and facilities for the handicapped are required and shall be developed as an overall system together with the signage required for the building as prescribed in TM 5-807-10.

(2) *Landscape Perception.* An important part of the landscape plan is consideration for the visual experience. A landscape is usually seen from an unlimited number of viewpoints, but a selected set of viewing positions can be designed into the landscape plan from where special features would be enhanced when viewed from those positions. Viewing positions will be established in conjunction with the design of the pedestrian system and the architectural image of the building. Sight lines from these positions must be carefully analyzed with respect to the visual and other aesthetic experiences to be created by the landscape plan; and with respect to the overall image to be established for the library. Sight lines from inside building windows are also important in developing the landscape plan as windows function as focal points on the landscape as well as provide natural light.

(3) *Planting Design.* Existing land forms, trees and vegetation should be preserved and incorporated into the landscape plan wherever possible. Plants can be used to modify or enhance climatic characteristics, reduce noise levels and control the flow of air. New plant materials should be available locally, easily maintained, and compatible with the surrounding environment without excessive irrigation needs. Where new materials are used, the initial plant size should be adequate to give the desired visual and protective effects. Parking areas should be screened with buffer planting and variegated with substantial islands of vegetation. For details on planting design, reference should be made to TM-5-803-1.

(4) *Outside Furnishings.* Where outside activities or other functions such as study or waiting occur, appropriate furniture and equipment will be provided as part of the overall landscape plan. Provide bicycle racks to accommodate bicycle parking as appropriate. Trash receptacles, bollards, light standards, and other common site elements shall be designed as part of an overall scheme. Items, fully attached to the site or building, will be included as part of the construction contract. Portable items will be included as part of the Related Furnishings and Equipment information to be developed for procurement by the installation.

(5) *Lighting.* Provide general parking and walkway lighting of 2 foot-candles at ground level. Areas accessible to the handicapped after dark must be lighted to 5 foot-candles at ground level.

## 2-9 BUILDING DESIGN

Building design will basically conform to the project requirements previously established, and applicable DOD, Army, and Engineer criteria. The quality of building design may very well determine whether or not the facility will maintain its usefulness and value. In this respect, successful development of the building's architectural image, functional layout, structure and environmental support systems, and interior detailing is of prime importance.

a. **ARCHITECTURAL IMAGE.** The architectural image is established by the characteristics of design that make the building appear inviting, adapted to the environment, and identifiable as a library. Most of the considerations identified below can be applied both to separate libraries and to libraries which are a part of a larger facility.

(1) *Inviting Design Characteristics.* The library must be inviting and convenient to visitors as well as routine users. Especially important are the location, expression, and identification of entrances in relation to the primary pedestrian and vehicular approaches. The design of the library should reflect the scale and nature of the activities involved and invite participation therein.

(2) *Adaptation to Environmental Context.* One measurement of good building design is the success with which the facility is adapted to its particular environment. Specifically, such factors as site and climate provide the basis for determining appropriate architectural responses. For example, a hot, sunny environment requires a facility that provides protection from heat and glare, with entrances that accomplish a comfortable transition between the bright sun on the interior and the relatively dark exterior. In wet climates, rain protection at exits and between building elements should be considered, and in colder climates, compact buildings that increase floor space per unit area of exterior surface and door circulation should be used. Environmental considerations such as these are an integral part of an attractive and functional design.

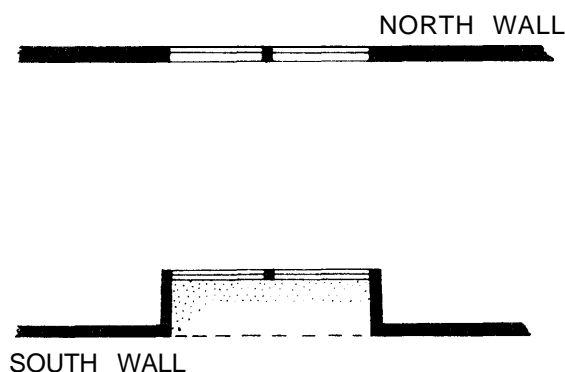
(3) *Facility Identity and Perception.* The library building or area must be readily identifiable as a unit and have a visually apparent organization that facilitates orientation and circulation. These basic perceptual qualities are essential to the further development of a system of viewing positions and settings to communicate the aesthetic intent of the building design. A series of viewing positions, intentionally planned into the approaches to the facility and continuing on into the space organization within, shall be established for this purpose, and identified in the design analysis. The settings will be composed of elements of the building design, such as the sizes and shapes of the buildings exterior masses and interior spaces, the color, texture, and lighting of those elements, and the visual articulation or decoration thereof.

(4) *Exterior Detailing.* The color, texture, and scale of building materials should generate visual interest, as well as establish characteristics appropriate to the overall scale and image of the installation. The articulation of the exterior mass of the building is also an important consideration.



(a) *Wall Shading.* A substantial proportion of the air-conditioning requirement for most buildings results from solar energy absorbed by building surfaces. By simply shading those portions of building receiving the most sun, cooling requirements can be significantly reduced. Methods of wall shading which should be considered include applying various forms of canopies or louvers to the walls, and use of deciduous trees. Each wall of the building may require a different treatment depending upon its orientation to the sun.

(b) *Control of Glass Area.* In cases where the shading methods (mentioned above) are not practical, the choice of window glass becomes important. At a radiation angle of incidence of 40 degrees, ordinary glass admits 85 percent of the solar thermal energy that strikes the glass surface, while reflective glass admits 63 percent, heat-absorbing glass 60 percent and certain specialized glasses as little as 28 percent. Windows may also be recessed as illustrated in Figure 2-1. Such a design shades the window glass, substantially reducing the amount of solar energy striking the glass surface.



**FIGURE 2-1 GLASS SHADING, SOUTH ELEVATION**

b. **FUNCTIONAL LAYOUT.** The layout of library facilities is an extremely important part of the building design, affecting both the operational efficiency and performance of library activities as well as the cost of construction. An effective functional layout must relate to a standard space module, accommodate circulation flow and adjacency requirements, and conform to life safety criteria.

(1) *Standard Space Module.* Buildings are generally more economical to construct if designed in relation to a standard space module. A commonly accepted module in the building industry is the 5-foot square. Systems such as for ceilings, walls, lighting and air distribution are manufactured to readily adapt to the 5-foot square module.

(2) *Standard Building Modules.* Due to potential changes in the library programs, the library building's structural/service systems must have a high degree of adaptability. Flexibility to change should be facilitated by

adopting open planning techniques and minimizing the extent of partitioning. Modular structural design should be provided to accommodate possible rearrangement or conversion of space to other uses. Modular floor and ceiling elements and zoned mechanical and electrical services are also desirable. Modules should conform to 5 foot increments to accommodate standard book shelf units and widely available structural systems. A 30 foot square module creates an efficient stack layout. (See paragraph 4-9.e.) and is used in most of the example layouts in this guide.

(3) *Adjacency Requirements.* In developing the building design to meet the performance needs of the library program, spaces must be laid out to achieve essential adjacency relationships. Basically, there are three kinds of spaces needed to accommodate most library program functions; staff spaces, collection/user spaces, and support service spaces. Each group of spaces represents in itself an overall adjacency relationship. Examples of the relationship of one group to another as an element of basic spatial organization is discussed in Chapter 5. The relationship of one individual space to another, as discussed in Chapter 4, is an element of functional layout. Generally, this is based on the degree of interaction of personnel, material or activities between two or more spaces. The greater the degree of interaction, the closer the spaces should be together unless there are interposing requirements for safety, or need for acoustic or visual separation.

(4) *Circulation Flow.* Corresponding with the layout of space adjacencies, a convenient and workable circulation flow must be established. The flow of users and staff; materials and services should not interfere with one another even though they must interface at certain points. Circulation requirements will greatly depend upon how well adjacency requirements are satisfied, and whether or not space organization assists orientation to the building.

(5) *Circulation Nodes.* Horizontal circulation spaces should widen at points of queuing and decision, such as at corridor intersections, toilets, and entrances to stairways. At building entrances, the circulation space must provide for entering personnel to orient themselves and exiting personnel to prepare for outdoor weather conditions. A circulation node should also be provided at elevators required for transport of book trucks and physically handicapped persons in multi-storied facilities.

(6) *Evacuation.* The building's functional layout must conform to life safety requirements. Evacuation during an emergency requires all of the occupants exiting the building safely. This, in turn, means that limitations may have to be placed upon space sizes, locations, and distances from exits. Also exits and passageways from the building must be sufficient in number and size. In most emergencies, elevators will become unusable; therefore, rescue areas or other measures may have to be considered for protection of the handicapped in multi-storied buildings.

(7) *Related Considerations.* Functional layout may also be affected by other considerations. For example, areas where surveillance is desired should be laid out in such a way as to allow visual control of circulation and other activities. Spaces with functions having common characteristics, such as high noise levels, fire hazards or special requirements for interior detailing, structure, and environmental support, should be grouped together insofar as functional requirements for adjacencies will allow. Analyses should incorporate these and other considerations as appropriate to meet the requirements of each individual project.

c. **STRUCTURE AND ENVIRONMENTAL SUPPORT.** A successful building design must provide economical structural and environmental support systems selected for their ability to effectively support functional requirements and to operate efficiently. Environmental support includes heating, ventilation and air-conditioning, lighting, electrical power and communication, plumbing, fire safety, and acoustics.

(1) *Structural Design.* Design loads and criteria will be in accordance with DOD 4270.1-M and TM 5-809-1 through TM 5-809-6 and TM 5-809-8 through TM 5-809-12. The structural systems and materials selected will be suitable for permanent type construction, be capable of carrying the required loads, conform to the standard space module, and be compatible with fire protection requirements, architectural concepts, and functional requirements. The structure selected will be that system which is the most economical and suitable based on comparative cost studies for the building.

(2) *Protective Construction.* Design of structures for protection against seismic events and wind storms is prescribed in TM 5-809-10 and TM 5-809-11 respectively. In locations where a deficit in PF 100 fallout shelter space exists under the Army Survival Measures Plan, described in AR 500-3, selected areas of the structure will also be designed for dual use as fallout shelters. Technical and other requirements will be in accordance with TM 5-800-1, Construction Criteria for Army Facilities. Single-line plans showing locations, occupant loads, and minimum protection factors for the selected shelter areas shall be developed and included in project design analyses and completion records.

(3) *Ventilation, Temperature and Humidity Control.* A controlled thermal environment is an important factor in designing comfortable, safe, and effective research spaces. Investigations in the area of human performance show that when temperature and humidity become high, working efficiency decreases, errors increase, and under extreme conditions health is adversely affected. All provisions must be consistent with applicable Occupational Safety and Health Act (OSHA) standards.

(a) *Temperature Control.* Whenever the daytime outside temperature is above 55°F, heat gains will usually outweigh losses. Therefore, the fundamental problem in controlling the thermal environment in a library is cooling,

rather than heating the facility. The desirable temperature for a building depends on the activity of its occupants. Acceptable temperature limits vary from 60-70° for vigorous activity to 68-70°F for sedentary activity. In a library, where sedentary and vigorous activities are usually separated, separate temperature zoning should be provided. For example, packing and loading areas should be zoned for lower temperature than reading or staff areas.

(b) *Humidity Control.* Relative humidity has little influence on comfort, provided that it is in the intermediate range (30 percent to 70 percent). Humidity levels above 70 percent can impair human performance and levels below 30 percent can cause respiratory discomfort and create undesirable levels of static electricity in activity spaces. In rare cases, the library may require a more closely controlled humidity for preservation of a costly or irreplaceable collection. Justification for such cases should be provided on the DD Form 1391.

(c) *Ventilation.* In a closed, occupied space, the amount of oxygen in the air decreases and the amount of carbon dioxide increases. Normally, ventilation of 6-10 air changes per hour is sufficient for maintaining the proper balance between oxygen and carbon dioxide. Dust, pollen, and bacteria should be eliminated by air filtration. Ventilation criteria for individual spaces are summarized in Chapter 4. Air distribution systems should provide uniform air velocities generally not exceeding 40 feet per minute for an air-conditioned draft-free environment.

(4) *Mechanical Design.* Heating, air-conditioning and mechanical ventilation shall conform to the applicable portions of DOD 4270.1-M and TM 5-810-1. Heating and air-conditioning load calculations shall comply with the procedures of the latest ASHRAE Handbook of Fundamentals. The "U" values for exterior walls, ceilings, and floors shall be in accordance with DOD 4270.1-M. Design temperatures shall be 68°F for heating; 78°F for cooling. Various systems should be considered to accommodate the environmental requirements of the different types of spaces in the facility. Selection will be based on performance, least energy use and cost of operation and maintenance. Energy recovery systems should be investigated and incorporated into the design if economical. Reason for selection and rejection of systems must be included in project design analyses.

(5) *Cleaning Systems.* Cleanliness and dust control are essential elements of library collection maintenance. Surfaces and materials used should be easily cleanable and free of dust and dirt emitting capabilities. Where wall-to-wall carpeting is used, outlets of central vacuum systems and/or diagonal grounded receptacles for portable cleaning machines, should be provided at vertical support elements in open areas but no more than 40 feet apart in any area. Design of electrical outlets and HVAC registers should provide protection against the intrusion of dirt, dust, discarded trash, etc., and, when mounted on or near the floor, against entry of water, detergents and alkaline during cleaning operations.

(6) *Toilet Fixtures.* Both female and male toilets shall be provided to allow for convenient use by staff and users, including those who may be handicapped. The male-female ratio and fixture allocation are specified in Chapter 4 under individual space criteria for toilets, paragraph 4-3.c. At least one water closet and lavatory for each sex will be provided for the physically handicapped in accordance with current criteria.

(7) *Plumbing Design.* Plumbing must be in accordance with TM 5-810-5 (and TM 5-810-6 if gas fittings are required). Water supply facilities must be as prescribed in TM 5-813-3 and 6. Sanitary sewers must be as prescribed in TM 5-814-1. Plumbing and fixtures shall comply with the "American National Plumbing Code A 40.8" or the "National Standard Plumbing Code," within the limits established by DOD 4270.1-M.

(8) *Electrical Design.* Electrical design must conform to DOD 4270.1-M and TMs 5-811-1 through 4. The system selected will provide efficient and economical electrical service throughout the library. Voltages selected will be of the highest order consistent with the load served. Three phase 208Y/120 volts should generally be used to serve incandescent and small fluorescent or mercury vapor lighting loads, small power loads, and receptacles. Consideration should be given to the use of three-phase 480Y/277 volt systems where such is feasible. Distribution of power within the building should be located to afford maximum flexibility in room power supply and ready accessibility for circuit revisions. Primary electric service will be underground to a pad mounted transformer(s) located outside below grade where possible, and as close to the load centers as practicable. Building telephone service will also be underground with main terminal cabinets located in mechanical or electrical equipment rooms.

(9) *Lighting.* Light intensity criteria are given in the following chapters in maximum foot-candles (fc) with respect to task lighting, general lighting, special-effect lighting, etc. When criteria are not given, consult the latest edition of the Illuminating Engineering Society Lighting Handbook. Type of lighting should generally be fluorescent for general-area application, and incandescent for other applications. Provide sufficient switching capability to allow for reduction of light in areas that may be partially inactive. Requirements for dimmers and other special effects should be analyzed on a case-by-case basis and provided to create the image intended. Provisions must also be made for adjustment and/or relamping of light fixtures not readily accessible. Provide a master panel for lighting near the control desk.

(10) *Communications.* In accordance with current procedures in most localities, telephones and lines will be provided by the local communications-electronics officer. However, outlets, including those for public telephones, and empty telephone raceway systems will be provided as part of the building and designed accordingly. Designs must be coordinated with the local communications-electronics officer with evidence of such coordination pro-

vided in each project design analysis. Criteria for telephone outlets are given by number (and type) per use for individual spaces. Similar criteria are given for allocation of intercoms, public address speakers, and TV outlets where such systems are justified by the local using service. Care should be exercised to ensure placement of telephone outlets in areas requiring computer terminals, facsimile and other telecommunication facilities.

(11) *Life Safety.* Design provisions shall be made to ensure health and safety as set forth in Occupational Safety and Health Act (OSHA) standards and National Fire Protection Association (NFPA) codes augmented by DOD and Army criteria. Fire protection is a significant part of building design and involves the provision of resistive construction, detection and alarm systems, and extinguishment systems.

(a) *Resistive Construction.* Requirements for fire-rated walls, doors, floors, etc., depend upon the type of occupancy or hazards within a space. The objective is to contain and retard fires to allow evacuation, rescue and extinguishment. Resistive construction is especially important around passageways used for emergency exit.

(b) *Detection and Alarm.* Alarm systems are used as a general alert of danger whenever a fire occurs and is detected. Alarms can be supplemented by either heat or smoke detectors that sound an alarm automatically. In designing a system, consideration should be given to visual as well as audible alarms to aid those with hearing handicaps; to resisting vandalism; and to maintaining and checking the system's performance. Tie-in with the installation fire department may also be required along with annunciators to show which detectors and/or alarms are activated.

(c) *Extinguishment.* Sprinkler or other systems may be used or required in high hazard areas, e.g., in educational or storage spaces where hazardous materials are handled. These systems are normally activated automatically by heat. An automatic sprinkler system shall be provided in all portions of buildings located below the floor of exit; in all windowless classrooms, shops, and educational spaces not having exits leading directly to the outside; and in all shops, classrooms and storerooms in which hazardous materials are handled. Spaces where special electrical or mechanical devices such as computers, simulators, etc., are to be housed must be identified so that alternative extinguishment systems can be designed accordingly.

(d) *Safety Signals, Lights and Symbols.* Emergency exits from corridors should be marked so that a sign indicating the nearest exit is visible from every point in the corridor. Provisions for those with visual, as well as other physical impairments, must be made in accordance with applicable design criteria used in design for the physically handicapped. Illuminated exit signs and emergency lights for all emergency exits and passageways will be provided as required by the Life Safety Code, NFPA No. 101. The location of fire protection and other fire safety equipment

should be emphasized, where possible, with pictographs such as shown in Figure 2-2. Safety markings; signs for danger, warning or caution such as shown in Figure 2-3, should be designed in accordance with AR 385-30, Safety Color Code Markings and Signs, and OSHA requirements.

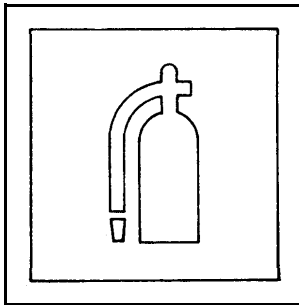


FIGURE 2-2

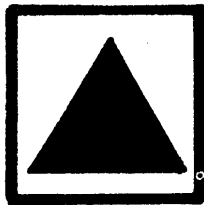


FIGURE 2-3

(12) *Fire Protection Design.* Criteria for fire protection, including fire and/or smoke detection, fire alarm, and extinguishment systems, are prescribed in DOD 4270.1-M, TM 5-813-6 and TM 5-812-1. These are generally based on the NFPA's National Fire Codes. Corridors, rooms, and exits must conform to the requirements for "flexible plan" buildings given in the NFPA Life Safety Code 101. Single-line plans showing fire-rated construction, location of detection and alarm systems, the location of exits and travel distances to them, areas where sprinkler and/or extinguishing systems are provided, and the location of other fire protection features shall be developed and included in project design analyses and completion records. These documents will indicate coordination of the fire safety design with the installation fire marshal.

(13) *Physical Security* The lock and keying system along with requirements for intrusion detection and protective lighting must be coordinated with the installation facilities engineer. Normally, locks will be grand master keyed to the installation's master key system with the library keyed to a sub-master key. The further need for master keys for selected parts of the library should be considered for large libraries. Overall, the physical security system must be designed so that its operation can be maintained effectively without interfering with life safety features.

#### (14) *Acoustics*

(a) *Ambient Noise.* Ambient noise is the back-

ground noise associated with a given space. It is generally a composite of sounds from mechanical equipment, street noise, and noise from nearby habitable spaces. The design ambient noise level for each library space is given in Chapter 4, in terms of A-weighted sound levels in decibels (dB).

(b) *Generated Noise.* Generated noise is the estimated overall peak airborne sound level in a given space, created by typical activities. The peak estimated sound levels for each individual space are also given in Chapter 4 for consideration in determining noise compatibility. These levels are generally 10-15 dB higher than the average long-term levels should be for each respective space.

(c) *Sound Quality.* This relates to the type of response a room should make to the noise generated within. A "live" room should have a low average absorption coefficient with hard surfaces to reflect most of the sound. Conversely, a "dead" room should have a high absorption coefficient with surfaces to absorb sound. Values given in Chapter 4 for sound quality are abbreviated as follows: L = live, ML = medium-live, AVE = average, MD = medium-dead, D = dead.

(d) *Sound Reduction.* Building design should allow a reduction in sound between library spaces as indicated in Table 2-3, Sound Reduction Goals. Each group of spaces have similar acoustic requirements. Reduction is achieved by a combination of interposed distance and barriers.

SOUND REDUCTION GOALS

Group	Spaces	Sound Reduction Goals (dB)			
		Group 1	Group 2	Group 3	Group 4
Group 1	Entrance Lobby Multi-Purpose Room Toilets Children's Collection Typing/Listening Room		45		
Group 2	Control Desk			50	
Group 3	Card Catalog Reference Periodicals Stacks Reading Study Carrels Research Carrels	20	45		
Group 4	Conference Computer Terminal Technical Services Admin. Librarian Post Librarian Ext. Collection	45	55		
Group 5	Shipping/Receiving Bookmobile	45			

Numbers represent sound reduction goals in decibels (dB) between spaces

Sound reduction should be measured in accordance with ASTM E 597-77T

TABLE 2-3

*(e) Effect of Distance and Interposing Barriers.*

Sound dissipates over distance. Doubling the distance from a sound source reduces the level of sound received by 6 dB. A similar reduction occurs for each doubling of distance between source and receiver. The operation of heavy armor or transportation equipment produces between 80 and 120 dB of sound at a distance of 20 feet. Aircraft may produce in excess of 140 dB. Assuming 100 dB at 20 feet, such sound would diminish to 94 dB at 40 feet, 88 dB at 80 feet, 82 dB at 160 feet, 76 dB at 320 feet on down to 34 dB at 40,000 feet (7 1/2 miles), etc. Since 35 decibels is the maximum desired ambient noise level for classrooms and study areas, distance alone generally is not a practical solution to reducing sound between the library environment and the outside environment or other related environments containing high noise-producing sources. However, if such sources can be located at a distance remote enough to allow reduction of the noise to an ambient noise level outside classrooms of 65 decibels, normal construction barriers can be reasonably designed to further reduce the noise to acceptable ambient levels within the classroom.

*(f) Background Noise.* Background noise is most distracting when the frequency range of the desired audio stimuli and the background noise are similar. For example, voice noise of 35 dB is more disruptive than mechanical ventilation noise of 35 dB.

*(g) Structural Considerations.* When libraries are located in facilities with high-intensity sound sources, these sources should be enclosed with sound-absorbing walls or shielded with sound-absorbing material. Machines that produce high-intensity structure-borne sound should

be acoustically isolated by special mounts. In such facilities, it may also be advisable to separate the library structurally from the rest of the building.

*(h) Mechanical Considerations.* Air-conditioning ducts may have to be treated to reduce noise transmission through the ducts. Space above ceilings, provided for distribution of ducts and other mechanical or electrical items, can allow excessive noise transmission from one space to another. Where such cases may occur, walls, or partitions should extend up to the underside of the roof or floor above.

**d. INTERIOR DETAILING.** The attractiveness and overall usefulness of the building are directly affected by the interior detailing of the building design. Interior detailing will be developed in conjunction with an overall interior design so that items which are part of the building contract are coordinated with related furnishings and equipment to be procured separately by the installation. Interior wall systems, finish materials, signage and color applications must be carefully considered in this regard. Permanent walls should be held to a minimum necessary for structural and fire resistance purposes. Transverse walls where practical should be semi-permanent or movable. Employ movable walls in those spaces in which changes in function of collection size are relatively frequent. Figure 2-4 shows some of the basic characteristics of the most common types of movable and semi-permanent interior wall systems. Table 2-4 provides data on the comparative costs and flexibility of wall systems. The designer must develop an accurate estimate of the frequency of functional change in a given space and, on that basis, select an appropriate interior wall system.

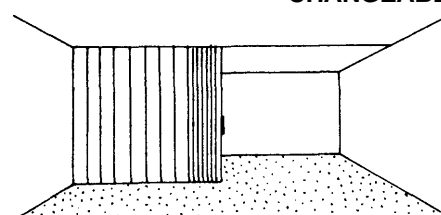
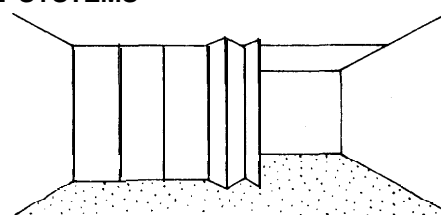
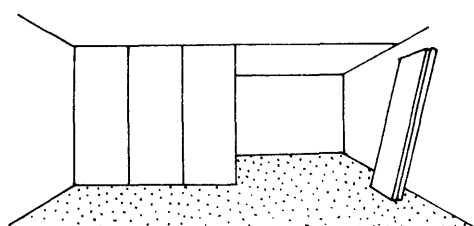
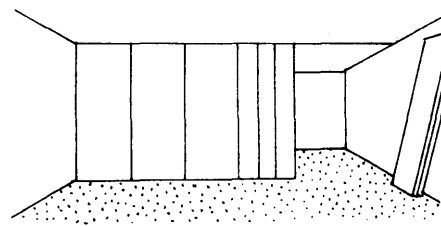
**CHANGEABLE WALL SYSTEMS****OPERABLE ACCORDIAN WALL****OPERABLE FOLDING PANEL WALL****PORTABLE PANEL****MOVABLE STUD AND FACING PANEL WALL****FIGURE 2-4**

TABLE 2-4 COMPARATIVE COST AND FLEXIBILITY OF WALL SYSTEMS

Partition Type	Relative cost	Change Frequency			
		Hourly	Daily	Monthly	Yearly
Fixed (non-load bearing) 6" Concrete Block or 5" Wood Stud & Plaster	1	No	No	No	Yes
Movable	1.8	No	No	Possible	Yes
Accordion	2.6	Yes	Yes	Yes	Yes
Portable	3.2	No	Possible	Yes	Yes
Folding Panel	5.4	Yes	Yes	Yes	Yes

## e. FUNCTIONAL OBJECTIVES

(1) *Circulation.* Depending on the nature of the activities involved, flows will be created for participants (staff and users), materials and, in some cases, furniture and equipment. Materials and equipment will include such items as may be required for instructional support, trash removal, repairs to the building and equipment, postal and vending service, etc. Circulation flows must interface at certain key points, yet not interfere with one another. Circulation of participants must allow for access-egress for physically handicapped persons and for safe evacuation of all persons in case of emergency. All such aspects must be incorporated into space organization in order to establish a workable, convenient, and efficient building and thus totally useful facility.

(2) *Adjacency.* The purpose and frequency of activities involved will establish patterns of compatibility and requirements for spaces to be adjacent to, or isolated from, one another. Adjacency is described in this guide in terms of the following criteria:

*Adjacent—spaces* with a shared wall or border, with direct access to each other.

Near 25 —spaces no more than 25 feet from each other —equivalent to maximum talking distance or 10-second walk.

Near 75 —spaces no more than 75 feet from each other —equivalent to maximum visual control or a 30-second walk.

Isolated —spaces isolated from each other to provide distance between noise or distraction.

(3) *Open Plan Flexibility.* Flexibility to change the function of library spaces should be facilitated through open planning by minimizing the extent of partitioning. Layout flexibility in structure and mechanical and electrical services should also exist so that spaces within the library can be utilized for different purposes without major alterations.

## 2-10 STRUCTURAL SYSTEM

a. *SELECTION.* Structural design loads and criteria must be in accordance with DOD 4270.1-M and TM 5-809-1 through 11, as applicable. The structural systems and materials selected shall be suitable for permanent type military facilities, capable of carrying the required loads, and compatible with fire protection requirements and architectural and functional concepts. Materials shall be selected for economy, general availability, and low maintenance costs over the design life of the facility. The structural system and features selected for construction drawings should be economical and suitable based on comparative cost studies for the building. Comparative cost studies should be made for the three most apparent competitive systems and should take into account mechanical, electrical, and other features.

b. *FLOOR CAPACITY.* To allow the greatest flexibility in floor layout and to provide for expansion of the collection, floors should be designed for a live load of 150 pounds per square foot throughout the building, except in toilets, bookmobile garages, and shipping/receiving areas. This loading will allow storage of approximately 15 books per square foot of stack area.

c. *PROTECTIVE CONSTRUCTION.* For areas where a deficit in PF 100 fallout shelter space exists under the Army Survival Measures Plan, described in AR 500-3, selected areas of the structure should be designed for dual use as fallout shelters. Technical and other requirements must be in accordance with TM 5-800-1. Single line plans showing locations, number, and the minimum protection factor for shelter spaces should be developed where applicable and included in the design analysis and completion records.

## 2-11 SITE DESIGN

Development of project site designs must be accomplished in accordance with applicable portions of DOD 4270.1-M and the Completed Project Development Brochure. Site design in general should be in accordance with TM 5-803-5. In addition, the following criteria should be considered:

### a. BUILDING—SITE RELATIONSHIPS

(1) *Solar Loading.* Buildings must be oriented to minimize solar loads in order to reduce energy consumption for air-conditioning. Maximum direct radiation is received by a surface that is perpendicular to the sun's rays. Structures will receive substantially different amounts of radiation depending on their orientation. In general, buildings oriented so that their maximum exposed wall faces south will be most conserving of energy. In the cold climates, most of the spaces in the library should get some sun on a winter day. Also, spaces with large glass areas should not face toward the low western sun of summer, which is difficult to shield.

(2) *Wind.* Structures affect air movement. They block or divert winds or channel them through narrow openings. Normally, the entrance should face away from the prevailing winds, or should be shielded by vegetation or part of the building. Features should be placed on the site so as to control wind-blown trash and snow.

(3) *Views.* A landscape is usually seen from a limited set of viewpoints, such as from windows, entrances, terraces, balconies and paths. Sight lines from these critical points should be carefully analyzed. Windows should be located to provide contact with the natural environment as well as natural light.

(4) *Grading and Drainage.* Overlot grading must be established to provide positive drainage at a minimum 2 percent grade. Normally a 5 percent grade is provided for 10 feet adjacent to the building. Road alignments and overall grading should be designed for optimum preservation of existing ground forms, drainage patterns, and tree cover, to avoid excessive earth movement consistent with functional requirements. Grading should also be designed to aid access for the physically handicapped.

(5) *Exterior Utilities.* Utility areas, such as trash bins, transformers, utility connections, etc., should be screened to the maximum extent practicable by use of plantings, land forms, and architectural screens to blend with surroundings. Utilities located on roofs should be carefully studied during architectural detailing.

(6) *Site Coverage.* As a rule of thumb, the maximum recommended coverage of the site by the building is 40 percent. Optimum coverage is generally considered to be about 30 percent.

### b. VEHICULAR AND PEDESTRIAN SYSTEMS

(1) *Circulation.* Safe and convenient vehicular, pedestrian and parking systems must be established. Vehicular and pedestrian circulation should be separated to the maximum extent feasible. Walkways should be de-

signed to complement the natural flow of pedestrian traffic into and around the project. Provisions for the physically handicapped should be in accordance with current criteria. Design of roads, streets, and pavements is discussed in TM 5-822-1 through 3.

(2) *Service Access.* Service access must be provided for fire fighting equipment, trash removal and the bookmobile (if any). Unloading facilities for book deliveries must be orderly in appearance and must not conflict with pedestrian or vehicular traffic. Service areas and service roads must be sized to accommodate the turning radii and maneuvering requirements of the largest vehicles. At the same time, the extent of paving should be minimized. Screening of service areas should be accomplished in conjunction with the screening of exterior utilities.

## 2-12 FIRE PROTECTION AND SAFETY

a. **FIRE SAFETY SYSTEM.** Fire protection shall be as prescribed in DOD 4270.1-M, TM 5-812-1, and TM 5-813-6. The fire safety system must be coordinated with the mechanical systems proposed for the project. Smoke detectors shall be as required by installation fire marshal. Floor plans should show lines of measurement indicating the maximum distance from major activity areas to exit(s). Cigarette receptacles, drinking fountains, fire extinguisher cabinets, and other equipment mounted less than 7 feet above the floor should be recessed so as not to protrude into exitways.

b. **SPRINKLER SYSTEM.** A wet pipe sprinkler system is required in the public and staff areas.

c. **SYMBOLS/MARKINGS FOR FIRE CONTROLS.** Illuminated exit signs and emergency lights shall be provided for all emergency exits and passageways as required by the NFPA Life Safety Code No. 101. Fire protection and emergency symbols shall appear in white on red squares, with wording as required by OSHA. The locations of exits, fire protection and other safety equipment should be strongly emphasized, as appropriate. Safety markings should be designed in accordance with AR 385-30, Safety Color Markings and Signs. Where possible, pictographs should be used as shown in Figure 2-2.

d. **EMERGENCY (FIRE) EXITS.** Emergency exits should require exitor to break glass to open the door and should be equipped with an alarm. Uncontrolled exits are a frequent problem in libraries. Push bar exits, even with alarm, are not an effective deterrent to unauthorized exit with library materials.

## 2-13 FINISH DETAILS

a. **MATERIALS.** Select materials based on maintenance qualities considering the anticipated use, life cycle cost impact, fire and other safety requirements. Coordinate the decisions concerning the extent of carpet installation with the using service considering functional advantages such

as acoustics, safety and maintenance. Use native (local) materials to the greatest extent practicable. Long-life materials such as stone, tile, wood, plastic, and vinyl, should be used where they will not become quickly outdated. When change is anticipated, painted surfaces and removable coverings are relatively easy and inexpensive to refurbish and can be kept fresh and up-to-date in appearance. Coordinate the color and texture of materials to complement the overall building design and image desired.

b. **COLOR.** Use of color in Army facilities is limited to a practical number selected from Federal Standard 595A, Colors. General guidance for color selection is provided in TM 5-807-7, Colors for Buildings. Color should be used to stimulate human physical and emotional reactions and to enhance the overall functionality of the building. Use soft colors in study areas and consider brighter base colors and accents in casual seating spaces. In critical seating areas, glare, brilliant colors and great brightness differences, both in the lighting system and in the color of walls, floors, furnishings and equipment, should be avoided.

c. **SIGNAGE.** Signage shall be accomplished as prescribed in TM 5-807-10 for interior and exterior use. Coordinate final detail needs of the using service at the local level. The system should assure maximum economy ease of procurement and installation, and standardization of application throughout the building. It must inhibit vandalism but be flexible enough to enable the addition or deletion of information. The use of symbols instead of words is recommended where possible.

(a) *Notice Boards.* Notice boards help control clutter and can readily accommodate changing information. They should be used throughout the building wherever they will be most useful. A general notice board should be located in the entrance of the library. Smaller boards may be located next to entrances to activity areas where there is a need to elaborate upon the type of activity inside, or to give the names of participants or staff involved, schedules, etc. Simple notice boards can be created by providing a 2-foot to 6-foot wide field of a solid base color surmounted at the 7-foot level by a 6-inch white board with the word "Notices" in 4-inch lettering. One or two narrow cork strips at the 6-foot and 4-foot levels should be provided as required for thumbtacking notices.

(b) *Wall Graphics.* While mainly decorative, wall graphics may frequently incorporate useful information such as floor numbers, directional indicators and Army insignia. When properly designed for the purpose, they can also be most effective in adding interest and creating focal points in otherwise visually dull spaces, such as large rooms and circulation spaces. Art prints available for loan at the library should be displayed at strategic points throughout the building to augment the wall graphics and interior furnishment. Gallery walls should be provided with tracklights for illuminating the art prints.

## 2-14 INTERIOR FURNISHMENT

### a. REQUIREMENTS

(1) *Coordination.* Final selection and layout of interior furnishings must be coordinated with the facility design. All features of the building, whether they are furnished and installed as part of the construction contract, or later provided by the using service from programmed OMA funds (see para 2-5) must be developed as an overall scheme. Final requirements shall be coordinated with the using service and the installation. Furnishings which are not part of the construction contract must be identified for procurement by the using service.

(2) *Mandatory Sources.* Items must be finally selected from the most current GSA Federal Supply Schedules, the Federal Prison Industries Schedule of Products and the GSA General Supply Catalog. Procurement by the using service from these sources is mandatory insofar as the items covered meet requirements. For items not listed in the mandatory sources above but which are part of the overall design scheme, appropriate guidance should be provided to allow procurement by the using service. Mandatory source schedules and catalogs must be reviewed carefully for their currency, as they may change to some extent quarterly to reflect cost changes and additions or deletions of contract items.

(3) *Layouts and Schedules.* Furnishing layouts and schedules must be in a form that can be readily understood by contractor and installation personnel who are responsible for procurement, and by personnel who are responsible for component placement and utilization after delivery. Display sheets consisting of placement plans, catalog illustrations, material/color samples, and perspective sketches of typical spaces, together with procurement lists, source data, and cost, should be developed as appropriate to accomplish this objective. Principal requirements and typical layouts are given for some individual spaces in Chapters 6 through 12.

### b. SELECTION CRITERIA

(1) *Appearance.* Furniture is an integral part of the overall facility design and must be closely coordinated with the selection of colors and finish materials for consistency in appearance and quality. Clear relationships between the furnishings finish schedule and the finish schedules in the facility design documents should be evident.

(2) *Durability, Comfort, and Safety.* Careful attention must be given to all interior furnishings to ensure that the type of furniture chosen conforms to standards of durability, comfort, and safety appropriate for the use they will receive. Being generally mobile, furniture items are subject to handling. Parts that receive the most wear should be replaceable, and finishes should sustain regular cleaning. Colors, textures, sizes, proportions, shapes, and reflections are important comfort factors that should be considered. Furniture and equipment must withstand loading conditions without damage. Edges and surfaces should be smooth and rounded. Materials must be flame-retardant.



(3) *Mobility and Interchangeability.* Most interior furnishings should not require more than two persons to relocate them, or require an undue amount of time to assemble and disassemble. Whenever possible, care should be taken to choose multi-purpose furnishings aesthetically suitable for a variety of needs and activities. Stackable and foldable furniture should be considered for reducing bulkiness in storage and transport.

#### 2-15 PROVISIONS OF USER INFORMATION

Records required upon completion of building projects are delineated in AR 415-10. Requirements for additional user information are established in ER 1110-345-700, Design Analysis. In developing designs, attention should be given to maximizing the efficiency of operating, maintaining and utilizing the facility, its spaces, built-in features, equipment, and furniture. Design features which facilitate or aid functionality, housekeeping, etc., should be described and instructions prepared to supplement design analysis and project completion records. The objective is to identify how to best utilize the facility design in a way that facilitates understanding by using service personnel. The following types of information should be considered in developing designs and provided to the using service upon project completion.

##### a. SPECIAL CONSIDERATIONS

- (1) Barrier-free features
- (2) Energy conservation
- (3) Occupational safety and health

##### b. SITE DESIGN

- (1) Utility service system
- (2) Landscape features

##### c. BUILDING DESIGN

- (1) Functional features of space organization
- (2) Space flexibility
- (3) Design perception system
- (4) Protective construction
- (5) Modular changeability
- (6) Environmental control features; HVAC, lighting, communications, etc.
- (7) Fire prevention system; detection-signal systems, evacuation routes, etc.
- (8) Security features, keying diagram
- (9) Housekeeping and services; supply, trash removal, storage, relamping, equipment repair, postal and engineer services, etc.
- (10) Finish materials maintenance

##### d. EQUIPMENT AND FURNITURE

- (1) Placement and flexibility
- (2) Storage and maintenance